

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended) A method of cell culture comprising:

confining a cell between first and second barriers, said barriers spaced at a distance to contact said cell and prevent said cell from traveling toward or away from each of said first and second barriers;

placing one or more spacers between said first and second barriers to prevent said first and second barriers over-compressing said cell; and

providing to said cell a culture substance,

wherein said first barrier is urged toward abutment with said second barrier and wherein said confining and said placing comprise at least partially separating said first and second barriers and introducing said cell and said one or more spacers between said first and second barriers, wherein said one or more spacers are rigid spheres.

2-4. (canceled)

5. (previously presented) The method of claim 1 wherein said providing comprises establishing a concentration gradient of said culture substance within said space.

6. (previously presented) The method of claim 1 further comprising manually positioning another cell adjacent said cell.

7. (previously presented) The method of claim 1 wherein said first and second barriers comprise first and second plates.

8. (previously presented) The method of claim 1 wherein a monolayer of cells is cultured between said barriers.

9. (previously presented) The method of claim 8, further comprising removing a cell from said monolayer of cells when said cell to be removed is observed to meet one or more criteria.

10. (original) The method of claim 9, wherein said one or more criteria are related to one or more of karyotype, morphology, and size.

11. (previously presented) The method of claim 1 further comprising:

limiting the number of cells surrounding said cell to permit control of a microenvironment surrounding said cell.

12. (canceled)

13. (previously presented) The method of claim 1 wherein said introducing comprises introducing a suspension of said cell and said one or more spacers between said first and second barriers.

14. (previously presented) The method of claim 1 further comprising fixing ends of said second barrier to said first barrier with an elastic fixative, said elastic fixative urging said first barrier toward abutment with said second barrier.

15. (previously presented) The method of claim 1 wherein said cell is confined between a surface of said first barrier and a surface of said second barrier, each surface selected to limit adhesion of said cell to said each surface.

16. (canceled)

17. (previously presented) The method of claim 1 wherein said providing comprises flowing said culture substance to said cell at a controlled rate.

18. (previously presented) The method of claim 7, wherein said plates are optically transparent.

19. (previously presented) The method of claim 1 wherein said providing comprises allowing said culture substance to permeate through one or both of said first and second barriers to between said first and second barriers.

20. (previously presented) The method of claim 1 further comprising sensing, with a sensor disposed adjacent a space between said first and second barriers, one or more of molecular concentration, temperature, osmolarity, pH, and shear force.

21. (previously presented) The method of claim 15 wherein said surface of said first barrier comprises molecules of a first type and said surface of said second barrier comprises molecules of a second type.

22. (canceled)

23. (currently amended) A combination of cell culture device and cell culture comprising:

first and second barriers and one or more spacers therebetween defining a desired cell culture space, said barriers contacting cells or bodies of cells constrained in said culture space, wherein the spacers are sufficiently rigid to resist movement of said first and second barriers and are sized to approximate the size of said cells or bodies of cells so as to prevent said first and second barriers from overly compressing said cells or bodies of cells; and

means for providing to said culture space a culture substance,

wherein said barriers comprise a microscope cover slip, and at least a portion of one of said barriers is transparent.

24. (original) The combination of claim 23 wherein said means for providing to said space a culture substance comprises one or more fluid passageways allowing fluid communication to and from said space.

25. (original) The combination of claim 24, wherein said one or more fluid passageways comprise one or more microfluidic channels each terminating adjacent said space.

26. (previously presented) The combination of claim 23 further comprising means for regulating fluid flow to or from said space.

27. (previously presented) The combination of claim 23 wherein at least one of said first and second barriers is permeable to nutrients and gases.

28. (previously presented) The combination of claim 23 further comprising means for monitoring said cells or bodies of cells constrained in said space.

29. (previously presented) The combination of claim 28 wherein said means for monitoring comprises a sensor.

30. (original) The combination of claim 29 wherein said sensor is a sensor for sensing one or more of molecular concentration, temperature, osmolarity, pH, and shear force.

31. (previously presented) The combination of claim 29 further comprising one or more transparent electrodes for connecting said sensor to a control system.

32-33. (canceled)

34. (currently amended) The combination of claim 23[[32]], wherein said portion of said barrier is made of a contact lens material.

35. (previously presented) The combination of claim 23 wherein at least one of said barriers is moveable for adjusting the size of said space.

36. (original) The combination of claim 35, further comprising an actuator for moving said at least one of said barriers.

37. (original) The combination of claim 36, wherein said actuator comprises one or more of an inflatable bladder, a screw, a lever, a clamp, a micrometer, and a piezoelectric crystal.

38. (previously presented) The combination of claim 23 wherein said one or more spacers are removable from said first or second barrier.

39. (previously presented) The combination of claim 23 wherein said one or more spacers are molded on said first or second barrier.

40. (previously presented) The combination of claim 23 further comprising a divider for dividing said space into a plurality of regions and for preventing said cells or bodies of cells from moving between said regions.

41. (previously presented) The combination of claim 40, wherein said divider is removable.

42. (previously presented) The combination of claim 23 wherein the surfaces of said barriers comprise different types of molecules.

43. (previously presented) The combination of claim 23 comprising a permeable membrane positioned to cover an opening adjacent said space for preventing said cells or bodies of cells from leaving said space through said opening.

44. (previously presented) The combination of claim 23 wherein said barriers define a plurality of spaces for confining a plurality of cells therebetween.

45. (previously presented) The combination of claim 23 which is included in a cartridge.

46. (previously presented) The combination of claim 23 further comprising a fluid culture medium which immerses said cells or bodies of cells.

47. (previously presented) The combination of claim 46, comprising a septum allowing access to said space with a syringe or a pipette.

48. (previously presented) The combination of claim 23 further comprising a capillary conduit for transporting a cell-containing fluid to or from said space.

49. (currently amended) A combination of a cell culturing device and a cell culture, comprising:
a container defining a chamber for receiving a fluid culture medium;
at least two barriers defining a space in said chamber;
an assembly of two or more cells constrained in said space so as to keep said assembly therein and in continuous contact with each of said at least two barriers during culturing; and
means for providing to said space a culture substance,
wherein one of said barriers is a microscope cover slip, and at least a portion of one of said barriers is transparent.

50. (previously presented) The combination of claim 49 wherein said space is sufficiently small to permit control of a microenvironment surrounding an individual cell in culture.

51. (previously presented) The combination of claim 49 wherein said assembly comprises a monolayer of cells.

52. (previously presented) The combination of claim 49 wherein said means for providing to said space a culture substance comprises one or more fluid passageways allowing fluid communication to and from said space.

53. (original) The combination of claim 52, wherein said one or more fluid passageways comprise one or more microfluidic channels terminating adjacent said space.

54. (previously presented) The combination of claim 49 further comprising means for regulating fluid flow to or from said space.

55. (previously presented) The combination of claim 49 wherein at least one of said at least two barriers is permeable to nutrients and gases.

56. (previously presented) The combination of claim 49 further comprising means for monitoring said cell constrained in said space.

57. (original) The combination of claim 56 wherein said means for monitoring comprises a sensor disposed in said chamber.

58. (original) The combination of claim 57 wherein said sensor is a sensor for sensing one or more of molecular concentration, temperature, osmolarity, pH, and shear force.

59. (previously presented) The combination of claim 57 further comprising one or more transparent electrodes for connecting said sensor to a control system.

60-61. (canceled)

62. (currently amended) The combination of claim 49[[61]], wherein said portion of said barrier is made of a contact lens material.

63. (previously presented) The combination of claim 49 wherein at least one of said barriers is moveable for adjusting the size of said space.

64. (original) The combination of claim 63, further comprising an actuator for moving said at least one of said barriers.

65. (original) The combination of claim 64, wherein said actuator comprises one or more of an inflatable bladder, a screw, a lever, a clamp, a micrometer, and a piezoelectric crystal.

66. (previously presented) The combination of claim 49 further comprising one or more spacers placed between said barriers for preventing said barriers over-compressing said cell.

67. (original) The combination of claim 66, wherein said one or more spacers are molded on one or more of said barriers.

68. (previously presented) The combination of claim 49 further comprising a divider for dividing said chamber into a plurality of regions and for preventing said cell from moving between said regions.

69. (original) The combination of claim 68, wherein said divider is removable from said container.

70. (previously presented) The combination of claim 49 wherein the surfaces of said barriers comprise different types of molecules.

71. (previously presented) The combination of claim 49 comprising a permeable membrane positioned to cover an opening adjacent said space for preventing a cell from leaving said space through said opening.

72. (previously presented) The combination of claim 49 wherein said barriers defining a plurality of spaces for confining a plurality of assembly of cells therebetween.

73. (previously presented) The combination of claim 49 which is included in a cartridge.

74. (previously presented) The combination of claim 49 further comprising said fluid culture medium which is contained in said chamber and immerses said assembly of cells.

75. (original) The combination of claim 74, wherein at least one wall of said container has a septum allowing access to said space with a syringe or a pipette.

76. (previously presented) The combination of claim 49 further comprising a capillary conduit for transporting a fluid to or from said space.

77-79. (canceled)

80. (currently amended) An apparatus for culturing cells in a controlled environment comprising:

i) first and second barriers and one or more spacers therebetween defining a desired confined space, wherein the distance between the barriers approximates the size of cells or bodies of cells to be cultured therein such that both the first and second barriers contact said cells or bodies of cells to impede their movement, wherein said spacers are sufficiently rigid to resist movement of said first and second barriers and prevent said first and second barriers from overly compressing said cells or bodies of cells.

ii) the inner surface of one or both of said first and second barriers having one or more characteristics or properties selected to mimic the characteristics of the biological environment of said cells;

iii) means for providing a culture substance to said space,
wherein one of said barriers is a microscope cover slip, and at least a portion of one of said barriers is transparent.

81. (original) The apparatus of claim 80 wherein said barriers comprise two opposing glass plates.

82. (previously presented) The apparatus of claim 80 wherein said space is so sized as to confine a single cell.

83. (previously presented) The apparatus of claim 80 wherein said space limits cells cultured therein to a monolayer.

84. (previously presented) The apparatus of claim 80 wherein said means for providing comprises one or more fluid passageways allowing fluid communication to and from said space.

85. (original) The apparatus of claim 84 wherein said one or more fluid passageways comprise one or more microfluidic channels terminating adjacent said space.

86. (previously presented) The apparatus of claim 80 further comprising means for regulating fluid flow to or from said space.

87. (previously presented) The apparatus of claim 80 wherein at least one of said barriers is permeable to nutrients and gases.

88. (previously presented) The apparatus of claim 80 further comprising means for monitoring a cell constrained in said space.

89. (previously presented) The apparatus of claim 88 wherein said means for monitoring comprises a sensor.

90. (original) The apparatus of claim 89 wherein said sensor is a sensor for sensing one or more of molecular concentration, temperature, osmolarity, pH, and shear force.

91. (previously presented) The apparatus of claim 89 further comprising one or more transparent electrodes for connecting said sensor to a control system.

92-93. (canceled)

94. (currently amended) The apparatus of claim 80[[93]], wherein said portion of said barrier is made of a contact lens material.

95. (previously presented) The apparatus of claim 80 wherein at least one of said barriers is moveable for adjusting the size of said space.

96. (original) The apparatus of claim 95, further comprising an actuator for moving said at least one of said barriers.

97. (original) The apparatus of claim 96, wherein said actuator comprises one or more of an inflatable bladder, a screw, a lever, a clamp, a micrometer, and a piezoelectric crystal.

98. (previously presented) The apparatus of claim 80 wherein said one or more spacers are removable from said first or second barrier.

99. (previously presented) The apparatus of claim 80 wherein said one or more spacers are molded on said first or second barrier.

100. (previously presented) The apparatus of claim 80 further comprising a divider for dividing said space into a plurality of regions and for preventing said cells or bodies of cells from moving between said regions.

101. (previously presented) The apparatus of claim 99, wherein said divider is removable.

102. (previously presented) The apparatus of claim 80 wherein the surfaces of said barriers comprise different types of molecules.

103. (previously presented) The apparatus of claim 80 comprising a permeable membrane positioned to cover an opening adjacent said space for preventing a cell from leaving said space through said opening.

104. (previously presented) The apparatus of claim 80 wherein said barriers defining a plurality of spaces for confining a plurality of cells therebetween.

105. (previously presented) The apparatus of claim 80 which is included in a cartridge.

106. (previously presented) The apparatus of claim 80 further comprising a fluid culture medium in said space.

107. (previously presented) The apparatus of claim 106, comprising a septum allowing access to said space with a syringe or a pipette.

108. (previously presented) The apparatus of claim 80 further comprising a capillary conduit for transporting a fluid to or from said space.

109-110. (canceled)

111. (currently amended) A method of cell culturing, comprising:

culturing one or more cells while restricting movement of said one or more cells such that each one of said one or more cells is in continuous contact with two opposing barrier surfaces and is mobile between said barrier surfaces, wherein said barrier surfaces are substantially parallel with each other; and

during said culturing, obtaining one or more images of said one or more cells.

112. (canceled)

113. (previously presented) The method of claim 111 wherein said barrier surfaces are substantially planar.

114. (canceled)

115. (currently amended) The method of claim 111[[114]], wherein said one or more images are obtained using a non-confocal imaging device.

116. (currently amended) The method of claim 111[[114]], wherein said one or more images are obtained using a bright field imaging device or a fluorescent imaging device.

117. (original) The method of claim 116, wherein said one or more images are obtained using a differential interference contrast (DIC) imaging device.

118. (currently amended) The method of claim 111[[114]] wherein said one or more images comprise a plurality of images taken over a period of time longer than about one day.

119. (currently amended) The method of claim 111[[114]] wherein said one or more images comprise a plurality of images taken over a period of time which is not limited by significant or substantial phototoxic effects to impose a constraint for gathering information on behavior histories of a cell or cells.